DEPARTMENT OF INDUSTRIES

BOMBAY PRESIDENCY

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1920-21

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OFFICE OF THE DIRECTOR OF INDUSTRIES,
New Custom House, Ballard Road:
Bombay, the 8th September 1921.

FROM

R. D. BELL, Esq., C.I.E., I.C.S.,
Director of Industries,
Bombay;

To

THE SECRETARY TO GOVERNMENT,
Revenue Department,
Bombay.

Sir,

I have the honour to submit the annual report of the Department of Industries for the year 1920-21 (1st August to 31st July).

2. At the beginning of the year I was on leave and Mr. Thiselton-Dyer continued to act as Director till my return in the beginning of December when he proceeded on nine months' leave. Since May 1919 the Director of Industries had also held the appointment of Controller of Munitions, Bombay Circle, but during 1920 the operations of the Munitions Board in Bombay were wound up and on my return in December the office of Controller of Munitions was closed. The Director of Industries is now the Chairman of the Sales Committee which advises regarding the disposal of surplus stores, but this involves no administrative duties. Throughout the year I was also in charge of the sale of German reparation dyes taken over under

the reparation clauses of the peace treaty. This involved considerable work in organisation at the outset but is now running on routine lines.

3. Another important *quasi* official duty of the Director is membership of a number of Committees. In addition to the Sales Committee I served on a committee to enquire into the working of the Government Central Press and am at present a member of a committee appointed under the chairmanship of Sir M. Visvesvaraya to draw up a scheme for technical and industrial education in the Presidency. I am also a trustee of the Victoria Jubilee Technical Institute, a member of the Committee of Direction for Technical Education and a member of the Provincial Co-operative Conference Committee. The total number of committee meetings attended during the eight months since my return from leave was fifty.

Expenditure.

4. The expenditure incurred by the Department during the financial year 1920-21 and the two preceding years has been as follows :—

	Rs.
1918-19	73,000
1919-20	1,56,000
1920-21	1,45,542

The final figures have not yet been obtained from the Accountant General, and practically all the expenditure incurred in the purchase of the trawler is excluded. Although the vessel was purchased more than a year ago I have not yet been able, although repeated enquiries have been made, to obtain an account of the disbursements by the Stores Department of the India Office.

Staff.

5. Mr. G. H. Thiselton-Dyer, who was appointed as Deputy Director of Industries at the end of 1919, has not yet been able to

organise his establishment. Immediately after his appointment he was required to act as Director for nine months, and thereafter proceeded on leave till the close of the year under report.

Mr. F. E. Bharucha held the appointment of Assistant Director of Industries, Northern Division, Ahmedabad, throughout the year, but till January last was engaged entirely in overhauling and repairing a dilapidated distillery plant belonging to Government.

The appointment of Executive Engineer in charge of the Central Store and Workshop at Dapuri, near Kirkee, has been held throughout the year by Mr. F. C. Davies and the appointment of Works Manager by Mr. C. Holliman. The latter was on leave till the end of January 1921.

Mr. E. R. Fern, Superintendent of Pottery at the Sir J. J. School of Art, continues to serve as pottery expert. Mr. Fern returned in December from six months' leave during which time Mr. C. P. Shah officiated.

For advice on matters relating to fisheries, Government have obtained from the Ministry of Fisheries and Agriculture, England, the temporary loan of the services of Mr. A. E. Hefford. Mr. Hefford arrived in India in December and holds the appointment of Marine Biologist. Mr. T. J. Walke remains as Superintendent of Fisheries.

On the chemistry side there are still no permanent arrangements as regards staff or laboratory accommodation and chemical problems continue to be taken up, in addition to their ordinary duties, by Dr. A. N. Meldrum, Professor of Chemistry, Gujarat College, Ahmedabad, who was assisted by Mr. D. M. Gangolli, and by Mr. A. J. Turner, now Principal of the Victoria Jubilee Technical Institute, Bombay, who is assisted by Mr. M. M. Koppikar. Dr. Meldrum was absent for most of the year on leave.

6. In November 1920 the Department lost the part-time services of Mr. T. S. Dawson who retired from his appointment as Principal of the Victoria Jubilee Technical Institute. Lieutenant

A. F. Yuill, formerly Assistant Controller (Oils and Paints), also resigned Government service to take up private employment. Mr. Yuill gave very valuable help to the Department in connection with the vegetable oil industry and the results of his enquiries have since been published in a departmental bulletin which is a great advance on anything hitherto published regarding this important industry in India. At the close of the year Mr. Gangolli, assistant to Dr. Meldrum, resigned his appointment to take up an important and well paid post elsewhere. I do not regret such a loss as this. One of the functions of the Department is to assist in training young chemists and mechanical engineers and, although it is a great handicap to lose the services of promising young men at the very time when the Department is expecting to reap the fruits of their training, the supply of trained men to private enterprise, on the one hand, and the well paid employment of the young men, on the other, are themselves objects worth attaining. Three honours graduates in science were provided at the close of the year with scholarships for training in technical chemistry at the Indian Institute of Science, Bangalore, while three men, of whom two were graduates in engineering, were selected for training in the engineering workshop at Dapuri.

7. All the staff mentioned above is still temporary. Throughout the year a great handicap was imposed on the Department by the number of officers who were on leave, by permanent losses of personnel, and by the performance during the first half of the year of other important duties by the Director and Mr. Bharucha.

Advisory Committee.

8. In March 1920 Mr. C. N. Wadia resigned and Mr. Nigel F. Paton, representing the Bombay Chamber of Commerce, vacated his place on the committee by proceeding on leave. In January 1921 the Hon'ble Mr. Chunilal V. Mehta, who represented the Indian Merchants' Chamber and Bureau, resigned on accepting the appointment of Minister. In March Mr. Purushottamdas

Thakurdas, C.I.E., M.B.E., Mr. Manmohandas Ramji, M.L.A., and Mr. A. J. Raymond retired by rotation and in April the committee unfortunately lost by death the valuable services of the late Mr. Rahimtulla Currimbhoy. Of last year's committee only two members now remain, *viz.*, Sir M. de P. Webb and Mr. A. T. Arnall. The members of the Committee now are :—

1. Director of Industries.
2. A. T. Arnall, Esq.
3. Sir M. de P. Webb, Kt., C.I.E., O.B.E., M.L.C. (representative of the Chamber of Commerce, Karachi).
4. Ambalal Sarabhai, Esq. (Ahmedabad).
5. Sir Alfred Chatterton, Kt., C.I.E.
6. H. P. W. Macnaghten, Esq., M.L.C. (representative of the Chamber of Commerce, Bombay).
7. Lalji Naranji, Esq. (representative of the Indian Merchants' Chamber and Bureau).
8. Cowasji Jehangir, Esq., C.I.E., O.B.E., M.L.C.
9. G. B. Trivedi, Esq., B.A., M.L.C.
10. Mangaldas Girdhardas, Esq., M.L.C. (Ahmedabad).
11. Rao Bahadur R. R. Kale, LL.B., M.L.C. (Satara).
12. Mahomedbhoy Currimbhoy, Esq.

No meetings of the Committee were held till my return from leave after which five meetings were held before the end of the year. In order to give the Committee an assured status and secure for it a practical working basis a statement of its functions was submitted to Government at the close of the year and has since been approved. This will give the Committee a close control over all the operations of the department. It is worth noting that six of the eleven non-official members are members of the Legislative Council so that popular control is well blended with business advice.

9. The principal subjects on which the advice of the Committee was tendered to Government were :—

(1) The principles and procedure according to which the law should be amended in order to permit of the compulsory acquisition of land for industrial purposes ;

(2) the terms of a concession for the collection of the oleo-gum-resin of *salai* (Boswellia Serrata) ;

(3) participation in the British Empire Exhibition, 1923 ;

(4) the organisation of an industrial bank ;

(5) an industrial and economic products section for the Prince of Wales Museum ; and

(6) participation in an all-India hand-weaving exhibition.

The Committee receives full monthly reports on the working of the steam trawler.

Policy.

10. The year was one of industrial depression ; this was reflected in the diminution of requests for advice in the selection and installation of small plants. These circumstances, the financial stringency, and the lack of personnel owing to resignations and leave reduced policy in many directions to marking time. There were therefore no notable developments in the department except in fisheries.

Cottage Industries.

11. *Hand-loom Weaving.*—The oldest sections of the Department of Industries is organised for the improvement of the hand-loom weaving industry. Its object is to introduce improved appliances and methods amongst the weaving population so as to raise the standard and increase the amount of their output. The most important mechanical improvement in handloom weaving in recent years has been the introduction of the fly shuttle slay of which large numbers are now in use in this presidency. By its means the output of the weaver is increased by something like 40 per cent. Another

useful appliance of which the use has been largely increased is the mechanical dobby of which there are several types. The weavers have also learned by experience the advantages of imported healds, reeds, shuttles and pirns over the country made articles and the former are in increasing demand.

12. The use of improved appliances and improved weaving methods is taught in two ways, namely, by means of weaving schools and by demonstrations. The weaving schools are equipped with fly shuttle looms,—khadi looms for beginners and saree looms for advanced pupils. Dobbies suited to the local weaving patterns are also supplied. There is a regular curriculum and instruction is given in the weaving of cotton and mercerised bordered sarees, silk sarees, dhoties, khans and cloths of intricate design. Provision is also made for lessons in simple arithmetic, but generally the boys who are admitted have already studied up to the fourth vernacular standard. Instruction is given free and for the first three months pupils receive a stipend of Rs. 3 monthly. Thereafter small prizes are given to the most regular attender and to the pupil who produces the best cloth. By this time the boys are able to earn a little in the school as the proceeds of their output are paid to them after deducting the cost of the yarn. They are encouraged to place a portion of their earnings in the Post Office savings bank so that on leaving the school they can set up for themselves with a fly shuttle loom and a dobby. Registers of old pupils are kept so that touch may be maintained after they leave school. Some of these schools have been very successful, the appliances and methods used by ex-students being readily adopted by other local weavers. In other cases the school propaganda has practically no influence on the local weavers. This is undoubtedly due to the deep-rooted conservatism of the weavers in some parts. The master of a weaving school who has made an instant success of his school in one town has failed after nearly two years' labour to produce any results in another.

13. At the beginning of the year there were two weaving schools, one at Bhivandi and the other at Sangamner. These were

transferred in November 1920 to Ahmednagar and Yeola (Nasik District),while a new school was opened at Belgaum in December. The Bhivandi school was a striking success and of 1,200 local throw-shuttle looms six or seven hundred had been fitted with fly shuttle slays when the school was closed. The manufacture of these slays is now a local industry. There are now also many small handweaving factories which work entirely with fly shuttle slays while several have adopted a double box motion the use of which was taught in the school. In addition to the increased output thus secured many of the local weavers now produce higher class cloth. Two looms were specially maintained at the school for this purpose and weavers who formerly prepared only sarees are now preparing silk khans, lace bordered sarees, and silk edged dhoties with special designs. I have dealt with Bhivandi at length because it exemplifies the standard which the Department seeks to reach in all the schools. The Sangamner school was also very successful, nearly 400 fly shuttle looms having been introduced before it was closed. At Yeola and Ahmednagar over 500 and 100 fly shuttle slays have been introduced already. At Belgaum progress has been slow but already 50 fly shuttle looms are at work, and a handloom factory has also been opened.

14. The demonstrations are on less elaborate lines. A demonstrator is sent to a weaving centre for about six months with two looms. On one of these he works with the appliances and methods which the department seeks to introduce and on the other any local weaver can receive instruction and practice for himself. In some villages the results from these demonstrations have been very satisfactory and they frequently evoke a request from the local weaving population that a weaving school should be opened in their village. At the beginning of the year four demonstrations were in progress, of which three have since been closed. Six new demonstrations were opened during the course of the year, all of which still continue. About 400 improved looms and the same number of dobbies have been introduced during the year as a result of these demonstrations.

15. The full staff of the weaving establishment is six head-masters, seven assistant masters and six weaving demonstrators. Owing to the difficulty of obtaining suitable men the staff is never at full strength and the demonstrations especially have been frequently interrupted by resignations and otherwise. It is almost impossible to get competent weaving masters and demonstrators ready made and all the department can do is to enlist suitable individuals and train them for their duties. The work of the schools and demonstrations is supervised by two assistants and the total annual cost of the section is about Rs. 15,000.

16. *Experiments in sizing.*—In connection with the weaving schools at Bhivandi and Ahmednagar experiments were carried out with a warping and sizing machine. The machine is much too expensive for the individual weaver but can frequently be used with advantage by the owner of a handloom factory. It requires more intelligent demonstration than it has received and I hope to make better arrangements for testing its use next year.

17. *Dyeing.*—A small dyeing demonstration was started last year at Sangamner at the request of the local weavers. The number of pupils rose from eight to thirty and there was something like a protest when the demonstration was transferred with the weaving school to Yeola in November 1920. At Yeola the demonstration was not successful and was finally brought to a close by the resignation of the demonstrator who obtained a better appointment in private service. A new demonstrator has recently been appointed and will begin work at Ahmedabad. In connection with the controlled distribution of alizarine dyes Mr. Bharucha came into close touch with the Ahmedabad calico printing industry. A Co-operative Society was formed but has been handicapped by the prevailing trade depression.

18. *Hand made paper.*—Assistance was given last year to the paper makers in Ahmedabad, chiefly in finding new customers. After consulting Mr. W. Raitt, the Cellulose Expert at the Forest

Research Institute, I reached the conclusion that there is no chance of improving this industry. At present it meets a certain demand and so long as this demand exists it will linger.

19. *Casein.*—The research work in connection with casein is dealt with later. A demonstration casein factory was started at Anand last December with the object of applying the results of the work done at the Gujarat College to the methods used for the manufacture of casein in the villages of the Kaira District. Kaira casein has earned a bad reputation in the world's markets not because the villagers cannot make fairly good casein but because hitherto the trade has not attempted to maintain a standard either by rejecting inferior casein or by grading according to quality. The result is that Indian casein now fetches nothing more than the price of the worst casein. Samples of caseins made at the Department's small factory at Anand were sent to London for opinion. Both the dealers consulted gave very favourable reports ; one expressed the opinion that the sample was as good as the average qualtiy of Argentine lactic casein. This means that a villager who will take the trouble to produce casein of similar quality can obtain a price probably 50 per cent. higher than he has hitherto obtained provided always that special arrangements are made for marketing it. At present if it is put on the market through the usual channels it will, as Indian casein, fetch exactly the same price as the worst qualities now made in Kaira. The casein made at Anand was analysed at Ahmedabad from time to time and the details of the process modified as the analytical results seemed to require. The methods used are capable of still further improvement. At the moment the propaganda work has been held up by the state of the casein market. Casein which sold for over £60 a ton in February realised only £30 in June while simultaneously the price of separated milk rose to a figure which made the profitable manufacture of casein impracticable. The important result is, however, that good casein has been made on much the same scale as that on which the Kaira villagers work and by a method and with appliances which the villagers can easily use.

20. The demonstration factory was visited by both local makers of casein and dealers. There is still a wide field for investigation. It is necessary to consider, for example, the numerous uses to which casein is put, to enquire which require good casein and to ascertain whether a few of these cannot be developed so as to establish a market for the good casein in India. There have already been demands for casein glue from various quarters and the glue supplied by the factory was admitted to be of a good quality. In two cases however it was unsuitable for the special purpose in view. This can probably be remedied by modifications in the formula. Glue is mentioned chiefly as an instance of the possibility of making local use of first class casein. Again, in the villages, the casein is all sun-dried and manufacture cannot be carried on during the rains. A simple type of drying machine has been designed by Mr. Bharucha and a trial of it will be made in due course at the demonstration factory.

21. Even a small project holds many difficulties at the outset. I desire to acknowledge assistance given at Anand by Mr. Frost, Assistant Director of Dairy Farms and the successive managers of the Government creamery. Mr. C. B, Almoula, B.A., B.Sc., the supervisor of the factory, did excellent work.

22. *General.*—It is not always realised that the improvement of cottage and small scale industries cannot be effected without an adequate and qualified staff. For handloom weaving the technical knowledge required is not of a high order, but for the improvement of dyeing methods considerable technical knowledge is required as well as skill and experience. Even for such a simple village industry as casein making research work of a high order is necessary before improved methods can be devised and the application of these improved methods may require men with a scientific education. If other village industries are to be dealt with staff must be provided. There is a disposition amongst critics to suggest that, because the Department of Industries has some staff, it can tackle any problem; it is only necessary to point out that a demonstrator trained to intro-

duce an improved method of manufacturing casein cannot be switched on to improved weaving methods, or the manufacture of carpets, or the making of glass bangles—to state three instances at random. Before any of these industries can be dealt with enquiry is necessary to ascertain what are its weaknesses and to devise methods of removing its defects. After a course of action is made clear it is seldom that demonstrators for propaganda work can be found ready made and measures must be taken to train them. Again, the Department has also always to keep in mind the fact that it is useless to train artisans to produce better goods unless a better price is obtained for the improved article. It is certain, for instance, that when the casein market improves the makers of good casein in Kaira District will not obtain a fair price for their production unless the Department of Industries takes special steps in the matter. The tax-payer rightly expects, moreover, that the gain to the producer will be good value for the public money spent on research and demonstration. Nothing can be done without a call on the tax-payer and nothing should be done with his money which is not a sound business proposition.

Technical Advice and Assistance.

23. As already mentioned there was a decrease in the requests for technical assistance. During the year a plant for refining common salt was erected at Kharaghoda to plans prepared by Messrs. Dawson and Turner. It is of an experimental character and capable of dealing with two tons per twenty-four hour day. There were, as might be expected, initial difficulties in getting the requisite degree of fineness but, with Mr. Turner's assistance, these were overcome and salt is now being marketted which is equal in quality and fineness to the salt used in creameries and for consumption in Bengal. The prospects of the experiment are therefore promising.

24. Full enquiries were completed regarding the manufacture of aluminium combs and the metal parts of umbrellas but the intending promoters of the factories have apparently been discouraged by prevailing conditions from embarking on these ventures at present.

25. Mr. Bharucha was unable to attend to his ordinary duties till the end of January. Thereafter he gave advice at Ahmedabad regarding design and construction of new chimneys, reservoirs and mill buildings. He also designed a cooling tower for the hot water from the engine condenser of a flour mill ; the design was carried out and works satisfactorily. Other advice of a technical nature and regarding plant and machinery was given. This branch of the Department's activities has hitherto remained practically untouched for lack of staff but I hope that some progress will now be made. In some instances the advice and assistance is not of a kind which can be given free and fees are charged in suitable cases. The total fees charged and credited to Government during the year amounted to Rs. 700 in addition to fees for analyses.

26. Mr. Bharucha also visited Malegaon (Nasik District) and made arrangements in conjunction with the local honorary organiser of Co-operative Societies, for a local company establishing works for dyeing cotton yarn by modern methods. The greater part of the population of Malegaon depends, directly or indirectly, on hand-loom weaving and the first big success in the introduction of fly shuttle looms was scored here by the Registrar of Co-operative Societies.

27. In April the project for the dyeing shed was so far advanced that some of the leading promoters were invited to Bombay to discuss the final arrangements for plant and the engagement of an experienced dyer. I was then informed that the managers were being boycotted by non-co-operators and they had therefore decided to postpone the execution of their plans till local feeling quieted down. It was later explained that a majority of the shareholders had become non-co-operators. A few days later rioting occurred and apparently destroyed, for the time, all hopes of the local people sinking political differences to co-operate in industrial enterprise.

28. The difficulties in the way of providing technical assistance have been mentioned with reference to cottage industries ; they natur-

ally increase with the scale of the industry. A purely indigenous industry which requires and is prepared to pay for technical aid is the glass industry which is now represented in the province by over a dozen glass factories. The Government of India have made efforts for over a year to secure two experts but so far without success.

Chemical Research.

29. This is probably the most fascinating aspect of industrial development in India at the present time, but in discussing it popular writers are apt to overlook the fact that the object of industry is not merely to make articles but to sell them *at a profit.* In discussing chemical research and chemical industries there is naturally a tendency to concentrate on the possibility of the chemical operation and to neglect the commercial aspects. The commercial aspects of various chemical industries in India have recently been examined by Dr. H. C. Watson of the Indian Institute of Science and, by an ingenious system of awarding points, he has made rough estimates of the commercial prospects in India of each of 33 chemical industries. By his method of calculation an industry for which all commercial factors are good obtains 9 points whereas one for which all factors are very unfavourable obtains 27 points.

30. *Casein.*—I refer to Dr. Watson's paper because one of the industries of which the possibilities are estimated by him is casein which is the sixth in the order of merit on his list with 14 points, the salt industry heading the list with 11 points. It is interesting to have so much justification for the research work undertaken on casein at Ahmedabad by Dr. Meldrum and Mr. Gangolli. During the year a second bulletin was published dealing specially with the proportion of fat in casein. The circumstances which led to the publication of this bulletin are of interest. The investigators had already arrived at the conclusions that a low fat content was essential to a good casein and that a low fat content in the casein could only be reached by thorough elimination of fat from the separated milk.

A sample of the casein prepared at Ahmedabad was sent to the Imperial Institute, London, which reported that the casein was regarded by experts as of good quality and that material equal to the sample would find a ready market in the United Kingdom. Nevertheless, in spite of this approval by experts, and in spite of the fact that the casein had been prepared with special care so as to ensure that it should contain a minimum amount of fat and had been found on analysis in India to contain only 0·24 per cent. of fat, the Imperial Institute reported that their analysis of the fat content showed 7·4 per cent. It was at least singular that two analyses should differ so widely and while Dr. Meldrum and Mr. Gangolli admitted that their methods did not give absolute results they could not believe that they indicated only one-thirtieth of the true value. They were thus led, in the first instance, to investigate methods for determining the amount of fat in casein and the first part of the bulletin deals with methods of analysis. It was a matter, however, of greater importance to decide definitely that casein approved as good could not contain 7 per cent. of fat, as the analysis of the Imperial Institute would mean that fat in casein is under estimated not only in Ahmedabad but all over the world. Dr. Meldrum and Mr. Gangolli were therefore induced to investigate the matter thoroughly and were able(1) to indicate the probable source of error in the Imperial Institute analysis, (2) to devise an absolute method for determining fat in casein, and (3) to vindicate the methods which they and chemists in other parts of the world had previously used.

31. The second part of the bulletin deals with the practical problem of the elimination of fat. The subject has been dealt with at length here in order to illustrate how the improvement of a simple village industry may depend on research work of a high order and how there may arise out of the apparently simple practical problems of the villagers issues of a purely scientific nature which must be settled before a sound solution of the practical problems is assured.

32. It is creditable to the Department that Mr. Gangolli should have received the degree of M.Sc., Bombay University, solely on

account of a thesis that was based on the work that he did on casein and that he should have been appointed to an important post at Rangoon. Mr. Gangolli directed the work of the demonstration casein factory (paragraph 19) from the beginning.

33. *Castor oil.*—Work was also done by Mr. Gangolli on the treatment of castor oil. Simple methods were devised for reducing the acidity of this oil and the results on the small scale have been quite satisfactory. What is now needed is a trial of the method on the "semi-large scale" with the use of a centrifugal separator to clarify the oil. The vegetable oil industry is important at Ahmedabad and I have encouraged it to make use of the services of the chemical staff by charging low fees meantime for analytical work. The remaining work was routine analysis.

34. *Bitterns.*—The principal research work of Messrs. Turner and Koppikar was again concerned with the development of the bitterns industry at Kharaghoda. The bitterns are the mother liquors left after the extraction of common salt from the brines which occur in this locality. The magnesium chloride produced locally, though perfectly white in the crystal, shows signs of discolouration when the crystals are fused preparatory to filling the drums in which the chemical is placed on the market. As the imported article is generally fairly white its superior appearance gives it a corresponding hold in the mill industry. Mr. Koppikar conducted a number of experiments on large scale batches of material at the factory itself. The results varied. Although in some cases a translucent salt was obtained the results could not be repeated with certainty. Laboratory experiments are now being conducted in Bombay to determine the correct working temperature for the final stage. Except for the colour the quality, which will be mentioned again below, is quite satisfactory. The manufacturing company added during the year to its equipment a motor wagon for conveying the bitterns from the salt pans to the company's factory. It is also making efforts to sell its output in foreign markets, and a concession as regards royalty has been submitted for the consideration of Government.

35. The production of epsom salts received further but, owing to lack of suitable apparatus, inadequate attention. The earliest experiments were directed towards recovering epsom salts from the sludge left after the extraction of the magnesium chloride from the bitterns, but it seems probable that a better line of attack will be to extract the epsom salts from the bitterns first and afterwards to recover the magnesium chloride from the residue. The experiments had to be suspended till suitable apparatus, now on order, is received. Experiments were made on extracting epsom salts from hard sludge. Experiments on a " semi-large " scale were successful; commercial production has not yet been considered.

36. The bitterns of Kharaghoda offer great opportunities for scientific research as well as prospects of economic development. Inorder to check the results obtained in India a large range of samples of brines, bitterns, salts and sludges were sent last year for independent analyses to the Government Laboratory, London. The report of the Government chemist stated that " all the samples " (of magnesium chloride) " may be considered good commercial magnesium chloride (fully hydrated)."

37. The presence of potassium salts and bromine in the brines and bitterns is confirmed by the analyses of the Government chemist. Regarding these I quote below the remarks made by the Department of Scientific and Industrial Research, London, through which the report was forwarded. " Perusal of Sir James Dobbie's report indicates that the samples of brines and bitterns collected in accordance with his directions contain such quantities of potassium and bromine compounds as warrant careful consideration of the possibility of extracting these valuable bye-products on a technical scale. .....The figures given above, considered in the light of the present (and relatively small) output of salt and of the potentially great future output, appear to indicate that the valuable bye-products, potassium chloride and magnesium bromide are obtainable in very considerable quantities in the Runn of Cutch.....A careful chemical survey of the district may possibly yield evidence

of the presence of other commercially valuable materials in workable quantities."

38. The Chemical Services Committee last year drew attention to the fact that little or nothing is known regarding the vast salt deposits of the Runn and that a thorough investigation of the area by a staff of skilled chemists is necessary to determine its industrial importance. Referring to this recommendation the Department of Scientific and Industrial Research has suggested that, pending action on it, tests upon a "semi-large scale" should immediately be put in hand in order that more exact information may be available when it is found possible to proceed further with the question.

39. There the matter rests for the present. As the royalties paid on the bitterns for the manufacture of magnesium chloride (as well as the income-tax paid by the company working them) are taken by the Imperial Government further expenditure can hardly be incurred by the Government of Bombay at the present time. But the work done so far by the Department of Industries has been justified both by the commercial success of the Pioneer Magnesia Company and by the suggestions for continued research by the Chemical Services Committee and the Department of Scientific and Industrial Research, London.

40. The miscellaneous work of Messrs. Turner and Koppikar consisted chiefly of analyses of minerals from Salsette undertaken at the instance of the Geological Survey. A complete collection of the lime-stones of the Presidency was also made. These are now under analysis.

41. *Trona.*—The results of a survey of the alkali deposits in Sind were given in the annual report of 1919-20. Experiments were subsequently made locally for improving the production of *chaniho* (crude sodium carbonate). The object of the experiments was not precisely understood at first, as the local authorities aimed at producing a pure sodium carbonate. It was pointed out that all that could be obtained by the methods suggested was a fairly

pure form of the mineral " trona " which is a combination of the carbonate and bicarbonate. This is itself a valuable commercial product worth producing and is the same as the crude soda of Lake Magadi. The reports of last season's work have not yet been received.

Pottery.

42. At the beginning of the year Mr. E. R. Fern, Superintendent of the Pottery Section of the Sir J. J. School of Art, was on leave and Mr. C. P. Shah acted for him till December.

43. *Work at the School of Art.*—The year was devoted principally to experiments with red clays found in the vicinity of Bombay. Exhaustive tests were made, with good results, of the manufacture of terra cotta bricks and flooring tiles while tests on glazed red wares were brought to a successful conclusion. China clay from one source was found suitable for high class porcelain ; cups and saucers made from it were quite as good as the best ware imported into Bombay. Earthenware cups, saucers and tea pots made from clays in Kathiawar were as good in quality as those of foreign manufacture but were not so white in colour. Several large pieces of majolica ware were successfully prepared to order and flooring tiles of various colours were made as good as the imported article.

44. These facts sufficiently indicate that suitable raw materials exist for the manufacture of flooring tiles and articles such as tea-pots for both of which classes there is a large local market. As the scheme for a demonstration pottery factory is still in suspense pending completion of the plans for the development of the area in which it will be located I am arranging that, at a slight expenditure, the equipment of the pottery section of the School of Art should be extended so as to permit of production of flooring tiles and tea-pots on a semi-commercial scale. This will give students a more practical training than they get at present, and will enable the market to be tested by locally made articles.

45. *China Clay.*—Two large deposits of China clay in the Southern Division were investigated by the Geological Survey and a three ton sample of one of these deposits was levigated under the superintendence of Mr. Fern and tested at a local spinning mill as to its suitability for sizing purposes. The results of these investigations and tests will be published separately by the Geological Survey.

46. *Local Resources.*—The Geological Survey made during the year a complete survey of the building resources of the Salsette Taluka and the clays surveyed were made into briquettes by Mr. Fern and about seventy tests were made for contraction, absorption, percolation and crushing strength. The full results will be separately published but it is worth noting here that the brick mixtures containing paddy husks mixed by the methods employed by local manufacturers, all showed very high percolation and absorption while the crushing strength in the majority of cases was extremely low. The same mixture ground to pass 17 mesh to the inch sieves had a better crushing strength but percolation and absorption were still both very high. It may be added that, in addition to the clay tests, arrangements were made for an equally large number of tests of building stones to be made at the College of Engineering, Poona. As already mentioned the minerals were analysed by Mr. Turner at the Victoria Jubilee Technical Institute.

47. *Waste Mica.*—A member of the Advisory Committee drew attention to the need of a market for waste mica. At the suggestion of the Director-General of Commercial Intelligence, Calcutta, experiments will be made with ground material in the manufacture of heat proof tiles and bricks as well of slate pencils.

48. *General.*—The total number of samples of clay, sands, etc., received for test during the year was 203, of which 176 had been tested before the end of the year. Nineteen persons visited the pottery to secure expert advice regarding clays and the establishment of pottery works. Mr. Fern also visited Malvan to advise the local potters and to inspect a local bed of kaolin which will be more

carefully investigated next cold weather. One of the local potters joined the pottery school. Fees for analyses amounted to Rs. 665.

Fisheries.

49. *Work in Kanara.*—Mr. Walke, Superintendent of Fisheries, with head quarters at Karwar, continued his work there till February last when he came to Bombay to assist the Marine Biologist in starting the trawler. One of his duties is to visit fish curing yards and assist the staff of the Salt Department in organising them on efficient and sanitary lines. Mr. Walke visited the Majali yard, where he carries out other work, 72 times and paid 21 visits to other yards. The better sanitary conditions introduced are believed to have been responsible for the absence of the blow fly in Kanara during the curing season for goal and shengala and both in Kanara and Ratnagiri when the moist curing process of mackerel was in progress.

50. Owing to the failure of the sardine season practically no further experimental work was done in the manufacture of fish oil and fish manure. Experiments were continued in fish curing and numbers of mackerel were smoked or cured. An experiment was also made in the pickling of fish. Some practical results of Mr. Walke's preliminary work are already apparent. A private fish oil factory was completed during the year although the absence of sardines prevented the owner from using it. The fish oil industry, with modern methods of hydrogenation, is capable of development but the lethargic fishing population of Kanara can be instructed only in fairly simple methods. In the Ratnagiri district Mr. Walke showed samples of salt fish, smoked fish, sardine oil and guano and found the local fishermen interested and willing to improve their methods provided they could get a market for their improved turn-out. As I have already pointed out success in all operations of this kind ultimately depends on securing a better price for the industry than it obtained before. Mr. Walke accordingly made arrangements for fish merchants to give orders at increased

prices for all fish cured according to his requirements. These arrangements will be continued during the ensuing season. Mr. Walke also gave assistance in forming co-operative societies of fishermen.

51. Arrangements were made during the year whereby the price of salt for fish curing was reduced from 12 to 10 annas in Kanara District and also to enable fishermen to purchase half their salt fine grained. The coarse grained Uran salt requires crushing before use and leads to delay and therefore deterioration of the fish in curing operations.

52. The closure of the oyster beds at Tadri in the Kanara District with a view to their recuperation has been subject to criticism. The order closing the beds has actually not been observed but despite disturbance useful observations were made with 200 limed tiles which were laid down for the oyster fry. No recuperative methods can hope to be successful, however, unless there is a period of protection for the immature shell fish.

53. *Trawling.*—With the object of making full enquiry into the conditions of the fishing industry on the West Coast and of making recommendations regarding the measures necessary for its development Government obtained during the year the loan of the services of Mr. A. E. Hefford as Marine Biologist from the Ministry of Agriculture and Fisheries in the United Kingdom. Mr. Hefford arrived in India in December last and after visits to Karwar, Calicut (where he inspected the operation of the Madras Fisheries Department) and Karachi, he became associated with the working of the steam trawler " William Carrick ". The steam trawler was purchased from the Admiralty in May 1920 but its fitting out was delayed by the disorganisation and congestion which then prevailed in the shipyard and engineering industries of Great Britain. Use was made of these delays, however, to investigate the commercial application of the brine freezing process for fish preservation in which noteworthy progress has been made in Denmark and Norway. After enquiry

in these countries and consultation with the expert of the Food Investigation Board in England a small brine freezing tank was installed on the steam trawler as an accessory to the refrigeration plant. The trawler arrived in Bombay in March, but the fittings and other work which had been postponed till her arrival in India were delayed by strikes in the local ship-building yards. Thus it was not till the 17th May that the vessel made its first voyage. Before the end of July seven trips had been made. The results of these are shown in the statement below :—

Voyage.	Total catch landed.	A				B			
		Catch per hour's trawling.				Catch per hour's absence from port.			
		Rays.	Dogfish, shark, sawfish, etc.	All others.	Total.	Rays.	Dogfish, shark, sawfish, etc.	All others.	Total.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
I ..	1,328	10	4	42	56	5	2	20	27
II ..	1,824	27	4	27	59	10	2	10	22
III ..	3,787	47	6	53	105	23	3	26	52
IV ..	5,234	27	4	73	105	22	3	58	83
V ..	20,993	86	11	93	190	74	9	80	164
VI ..	15,702	65	21	119	205	54	18	99	171
VII ..	3,248	67	1·4	189	251	28	1	80	106

It is obvious that the success of fishing operations is not measurable by the mere quantities landed, but by the rate at which they are caught. The productivity per hour is calculated in two forms (*a*) as catch per hour of trawling and (*b*) as catch per hour's absence from port. It will be noticed that there has been a steady improve-

ment in fishing results. The last three voyages were made under monsoon conditions but on the last voyage only three hauls could be made on account of the stormy weather, so that only a comparatively small proportion of the time of absence from port was spent in fishing operations.

54. The financial return for each voyage is also best indicated by the ration between the sale of the fish and the time occupied in catching it, as in the following table :—

Rate of gross earnings per hour's fishing and per hour's absence from port.

Voyage.	Sum realised.		
	For whole catch.	Per hour's fishing.	Per hour's absence from port.
	Rs.	Rs.	Rs.
I ..	230	8·25	4·6
II ..	273	8·8	3·3
III ..	581	16·1	8·0
IV ..	814	16·3	12·9
V ..	2,260½	20·5	17·7
VI ..	2,120–	27·7	23·0
VII ..	350	23·7	10·0

55. It is too early yet to estimate the possibilities of trawling on this side of India. Such an enterprise starts in Bombay with one essential condition of success namely a race of fishermen who, so far as mere fishing operations are concerned, have brought the industry to a high level. Everything considered, the crew of the trawler may be considered quite satisfactory, and as far as work at sea is concerned it is merely a question of ascertaining whether fish are obtainable. A single trawler operating from Bombay is at present handicapped, however, from the commercial point of view in many ways. In Britain trawling is not conducted by single trawlers any more than in Bombay weaving factories are run with a single loom.

The British steam trawler is a unit in a fleet which in many cases are all under the same ownership and in any case supply the same port, thus providing a relatively regular supply to meet a uniform and regular demand. With a single trawler supply must necessarily be somewhat spasmodic. Secondly, Bombay as a port is not organised in any way to meet the requirements of this class of vessel. Even in the smallest British fishing port a trawler is able to come in and, without delay, land her fish which are sold on the spot in a few hours and the proceeds of the sale known within a few minutes. Immediately she has landed her fish the trawler can at once take abroad coal, ice or other supplies and any repairs can be executed with equal facility and speed. All this is done under the eye of the owner whose office is on the fish quay. The trawler owner is, in practically all cases, also the salesman of the fish and generally a shareholder in the concerns that supply ice, coal and other stores. The better firms have got their own engineering shops for repairs. In Bombay the Government trawler is obliged to reach port the previous afternoon in order to make arrangements for landing its fish and carting them to the Crawford Market for sale. Comparatively long notice is required for the supply and transport of coal and ice and it is difficult to secure deliveries according to scheduled times. The water supply is obtained at present as a matter of favour. For work on the hull the trawler has to drydock in a basin suitable for a P. and O. Liner. By luck the landing place for the fish is only about a mile away from the Crawford Market. Not only is there great lack of working conveniences, but the necessity of employing outside agencies for supplies and repairs increases the delays and charges. I make these remarks so that it may be understood that although the "William Carrick" is working on commercial lines she can hardly be considered a commercial trawler. The conditions just explained impose a much larger proportion of time being spent in harbour than is compatible with commercial trawling. The circumstances of working organisation and business arrangements need not, however, prevent the staff from obtaining all data adequate to determine whether

trawling can be made a profitable industry. The chief sea work resolves itself into collecting complete data of the catch per hour.

56. There is another side of the experiment and that is the organisation of the local fish market. The scarcity and dearness of fish in Bombay has been a long heard cry. Part of the dearness is undoubtedly due to the primitive lines on which the fish trade, wholesale and retail, of Bombay is organised. At the time of the year when fish is most scarce in Bombay the trawler catches have realised, for pomfret 10 annas 5 pies per lb., for salmon 8 annas 10 pies, and for goal 6 annas 8 pies. These are the three kinds of fish in principal demand. The prices appear to bear little relation to the palatableness of the fish and depend rather upon local tastes and habits. The little known but excellent deep sea fish such as karel, palu, and tambusa are in little demand; they have been sold by the trawler for $2\frac{3}{4}$ to $3\frac{1}{4}$ annas per lb. Rays or skate, which are caught in greater quantity than any other sort, are little esteemed in the market and their average price is only one quarter of an anna per lb. A similar result was obtained in England when trawling was first introduced. Skate was then a glut on the market, now-a-days it is a popular edible fish.

57. The market results show that the high price of fish in Bombay is partly due to the primitive methods by which the fish trade is conducted and partly to the ignorance or prejudice of the fish-eating public regarding many good edible fishes.

Industrial Workshops at Dapuri.

58. These Workshops were transferred from the Public Works Department at the close of 1919, but owing to the absence on leave of Mr. Gosford, the officer in charge, and his subsequent death they have not changed materially in their organisation. With the assistance of a firm of chartered accountants the system of management and accounts is now being examined in order to place it on a commercial basis. Last year a system of apprenticeship was introduced

but has not yet been fully developed. Arrangements for giving the apprentices their ordinary education were inadequate and it is now proposed to entertain a full time school-master. When he is appointed the ordinary education of boys will be properly organised, and their pay will be regulated not only by their progress in the workshops but also by the standard of their work at school. Instruction in English and in technical drawing will be added. A beginning has also been made in the training of mechanical engineers properly so called and three appointments have been created on Rs. 150—25—200 to enable graduates in engineering to secure practical training. This is a part of the mechanical engineer's education of which the value is not fully recognised and to which in consequence little attention has been paid in India; in Europe and America its importance is recognised as supreme. A graduate in engineering in any country is not qualified for his professional career till he has put in two or three years hard training in commercial workshops, and to assist Indian graduates in obtaining this training the Department has undertaken the training of three on somewhat exceptional terms of remuneration for apprentices. Something of the kind was necessary to check the search for employment by graduates who had only a theoretical knowledge of mechanical engineering.

59. *Experimental Work.*—A small amount of experimental work is undertaken at the workshops. Two years ago Mr. T. S. Dawson devised an improved twisting machine for the silk industry at Surat. During the last year two machines to his designs were completed and will be handed over for trial to a silk factory. In an experiment of this type success is not obtained at the first venture and even when the machine is made mechanically perfect the question of cost is vital to its successful introduction in the industry. A set of experimental button making machines is also under manufacture. Two years ago a plant for the improved distillation of rosha grass oil which was designed at the Forest Research Institute, Dehra-Dun was completed and delivered. The first trials were satisfactory but the plant subsequently gave trouble. With the assistance of

Mr. Koppikar a new design was prepared at Dapuri and this, with minor modifications, has been approved by the Forest Research Institute.

60. The workshops have gradually been improved as a training school. In the last year, for instance, the number of apprentices has been increased from 17 to 45. Special attention is paid to the care of tools and every workman is taught, for example, the proper method of grinding tools for steel, iron and brass. The officer in charge of the workshops also gives advice and assistance to industries in Poona and neighbourhood.

Commercial and Industrial Intelligence.

61. The dissemination of commercial and industrial intelligance is, in several respects, the most important and useful work done by the Department. I do not refer now to publications, such as the bulletins on casein by Dr. Meldrum and Mr. Gangolli, and on the vegetable oil industry by Mr. A. F. Yuill, the latter of which is a comprehensive and really valuable contribution to the industrial literature of India. The really important work is done in answering the enquiries of private individuals and industrial firms. The general public is little aware of the great volume of information of industrial and commercial value which is regularly collected, tabulated and published by Government or which can be collected by special enquiry through Government agency. Business men may know that it is available but they cannot be expected to know exactly where to apply for every special item of information. As collecting centres and clearing houses of information required by industrial enterprise Departments of Industries must play a part of ever growing importance. Research, experimental work, pioneering, demonstrations, technical advice, assistance to cottage industries—all these frequently involve a struggle with outside prejudice, conservatism, ignorance and inefficiency. But as an intelligence bureau the department helps those who can help themselves. That the value of the department in this respect is winning recognition is shown by the fact that

the volume of inquiries grows steadily. Receipts of correspondence during the year were 7,049 against 5,959 in 1919-20, an increase of 20 per cent. It is becoming increasingly difficult to deal efficiently and promptly with all correspondence.

62. *Publications.*—The department has published four bulletins up to date; these are advertised in the covers of this report. As the series of Bulletins of Indian Industries and Labour and the Quarterly Journal of Indian Industries and Labour, which are published by the Government of India, now provide suitable means of publicity, additional provincial publications will only be issued in exceptional circumstances.

Concessions.

63. *Paper pulp.*—The syndicate to which a concession was granted in 1917 for the manufacture of paper pulp from bamboos in Kanara has abandoned its scheme, and the field is again open to other prospective manufacturers of paper pulp.

64. *Naval Stores.*—Another scheme which has been under examination for some years is the manufacture of turpentine and rosin from the oleo-gum-resin of Boswellia Serrata. The Advisory Committee have now recommended to Government the terms of a license for the collection of the crude resin.

65. *Matches.*—The Gujarat Islam Match Manufacturing Company was recommended for an extension of the concession under which they at present obtain their wood supplies.

Exhibitions.

66. In March 1920 the Department participated in the British Industries Fair but Government decided not to take part in that of 1921. The Department will be represented at the Fair again in 1922. Arrangements are also being made to participate in the British Empire Exhibition of 1923.

A small permanent local exhibition is required on the lines of the Commercial Museum, Calcutta, but so far neither space nor funds have been available.

The Department will participate in an All-India Weaving Exhibition to be held at Patna in November.

Miscellaneous.

67. *Coal Supplies.*—The coal situation was most acute for the greater part of the year. The glass factories especially suffered. This industry is in a special position. It requires first class coal to obtain the requisite temperatures; a stoppage involves the cooling down and cracking of the crucibles; and a long stoppage means the dispersal of labour which requires special training. At one time I made arrangements to pool the demands of this industry and get supplies for all factories from a single reliable firm but the authorities would not guarantee waggon supply. Fresh arrangements were made as the result of a conference at Simla, but the absence of complaints since then is probably due to other means which were taken to relieve the situation as a whole. India in passing through her industrial revolution seems, at the moment, to have outstripped her means of communication and coal supply is not the only direction in which industry will be handicapped till railways are improved to meet current requirements and future developments.

Conclusion.

68. The staff, in all sections, has worked, on the whole, with efficiency. The financial position has rendered it necessary for the Department to develope slowly, but this has rather aided in the perception of the special difficulties which are confronting it. These are such as inevitably arise where Government activity comes into contact with private enterprise and they naturally assume greater proportions as the industrial policy of Government tends to become

more active. Not the least is the difficulty of securing results commensurate with the expenditure involved. To assist them in solving the numerous problems which thus arise Government have hitherto been fortunate in the advice of the Advisory Committee which includes some of the foremost business men of the city. The influence and importance of this Committee are bound to increase and I gratefully acknowledge the advice and help which its members have afforded in the past year.

I have the honour to be,

Sir,

Your most obedient servant,

R. D. BELL,

Director of Industries, Bombay.

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List of Bulletins published by the Department of Industries, Bombay Presidency.

BULLETIN No. 1.

		Price. Rs. a. p.
Indian Casein, Part I	.. By D. M. Gangolli and Dr. A. N. Meldrum.	0 4 0

BULLETIN No. 2.

Utilisation of Bitterns	.. By A. J. Turner, B.Sc. (Lon.), F.I.C.	0 4 0

BULLETIN No. 3.

The Vegetable Oil Industry in the Bombay Presidency.	By A. F. Yuill ..	1 13 0

BULLETIN No. 4.

Indian Casein, Part II	.. By D. M. Gangolli and Dr. A. N. Meldrum.	0 5 6